A Simple One Step Line Search For Use In Quasi-Static Solid Mechanics Contact Calculations

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Adagio [1] is a quasi-static nonlinear finite element program for use in analyzing the deformation of solids. It is massively parallel, built upon the Sierra finite element framework [2], and employs the Acme library [3] for contact search algorithms. Contact enforcement is implemented within Adagio [4] and its mechanics and algorithms closely follow those previously developed in JAC2D by Biffle and Blanford [5] as well as Jas3d by Blanford et. al [6]. Adagio assumes a quasi-static theory in which material point velocities are retained but time rates of velocities are neglected. Sources of nonlinearities include nonlinear stress-strain relations, large displacements, large rotations, large strains, and frictional/frictionless contact mechanics. Quasi-static equilibrium is found using a nonlinear solution strategy which includes nonlinear conjugate gradients. In this paper, we describe the solution strategy for problems involving contact. We will focus on several key points that include a novel one step line search, and the use of linear solvers as preconditioners in our CG algorithm. We will discuss the implications of nodes transitioning between sticking and slipping during the line search.

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